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SOILS EXPLORATIONS AND FOUNDATION ENGINEERING
MATERIALS TESTING AND INSPECTION
NON-DESTRUCTIVE TESTING and MATERIALS EVALUATION

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November 24, 1981

Wayne Disposal, Inc.
P.O. Box 5187
Dearborn, MI 48128

Attn: Mr. Walter W. Tomyn, P.E.

Subject: Hydrogeological Study
Allen Park Clay Mine
Allen Park, Michigan
MTE File No. 406-15046

Gentlemen:

Attached please find ten copies of our hydrogeological report for the Allen Park Clay Mine Landfill study located in Wayne County, Michigan.

This report has been prepared for inclusion with Ford Motor Company's application for a hazardous waste disposal facility operating license as required by the Hazardous Waste Management Act 1979, P.A. 64.

If you should have any questions regarding this project, feel free to contact us.

Very truly yours,

MICHIGAN TESTING ENGINEERS, INC.

Marshall Austin
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FILE NO. 406-15046

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INTRODUCTION

General

This report presents the results and recommendations regarding the hydrogeological conditions at the Allen Park Clay Mine landfill site located in Wayne County, within the city limits of Allen Park, Michigan. The report has been prepared as required by the Michigan Department of Natural Resources in compliance with the Hazardous Waste Management Act 1979, P.A. 64 for inclusion with the application for hazardous waste disposal facility operating license.

Authorization to perform this exploration and analysis was in the form of a letter agreement dated July 29, 1981 from Wayne Disposal, Inc. (operators of Allen Park Clay Mine) to Michigan Testing Engineers, Inc.

Purpose

The purpose of the hydrogeological study was to determine the existing hydrogeological conditions; evaluate the potential for degradation of the ground and surface waters; and provide the basis for an effective and acceptable monitoring program.

Scope

The scope of work for our services regarding this project included:

1. Installation of five monitoring wells into the water bearing aquifer at or near the hardpan soils approximately 75 to 85 feet below the existing grade. The wells are to be used for sampling the groundwater and for studying the groundwater flow regime.

2. Securing soil samples (split spoon sampling in sands, shelby tubes in clays) during the well installation at intervals of; ten feet to the proposed trench bottom, every five feet for the next fifteen feet; then every 10 feet to the bottom of the boring. Laboratory tests performed on selected samples included: permeability determination, moisture contents, grain-size analysis (sieve and hydrometer) and Atterberg limits determination.

3. Obtain background information including: previous site studies, deep oil, water and gas wells, and existing hydrological information.

4. Determine subsurface soils and bedrock, their distribution, thickness and characteristics from field investigations (both past and present), other deep well logs and available geologic literature.

5. Determine hydrogeological conditions at the project area from available domestic well logs, previous hydrogeological reports and from current hydrogeological information obtained during this study. Determine surface drainage features and subsurface ground water flow from monitoring/observation wells and establish a subsurface ground water contour map.

6. Prepare a hydrogeological report including the above information and our recommendations for a ground water monitoring program.

Previous Explorations

Prior to this report, Michigan Testing Engineers, Inc. has conducted other subsurface explorations at this site. The results of these investigations were presented under MTE File Numbers 64-8519, 64-9623, 406-05042 and 401-00115. Pertinent information from each of these reports has been appended. A brief summary of each report follows.

File #64-8519 - Drilling of ten borings to depths ranging from 55.5 to 81 feet below the existing ground surface. Observation/monitoring wells were installed in four of the ten borings made. Laboratory testing consisted of classification and permeability determination of selected soil samples and chemical analysis of selected water samples.

File #64-9623 - Permeability tests were conducted on remolded, on-site silty clay samples to determine their suitability as a landfill cover (capping) material.

File #406-05042 - Installation of three, shallow groundwater observation wells.

File #401-00115 - Permeability tests were conducted using remolded, on-site bulk clay material used for construction of the perimeter dike.

DESCRIPTION OF SITE

Site Location

The Allen Park Clay Mine is bounded by Oakwood Boulevard, Interstate 94, Outer Drive, Snow Road and M-39 (Southfield Road). The site is located in Wayne County, within the city limits of Allen Park, Michigan (See Figures 1 and 2).

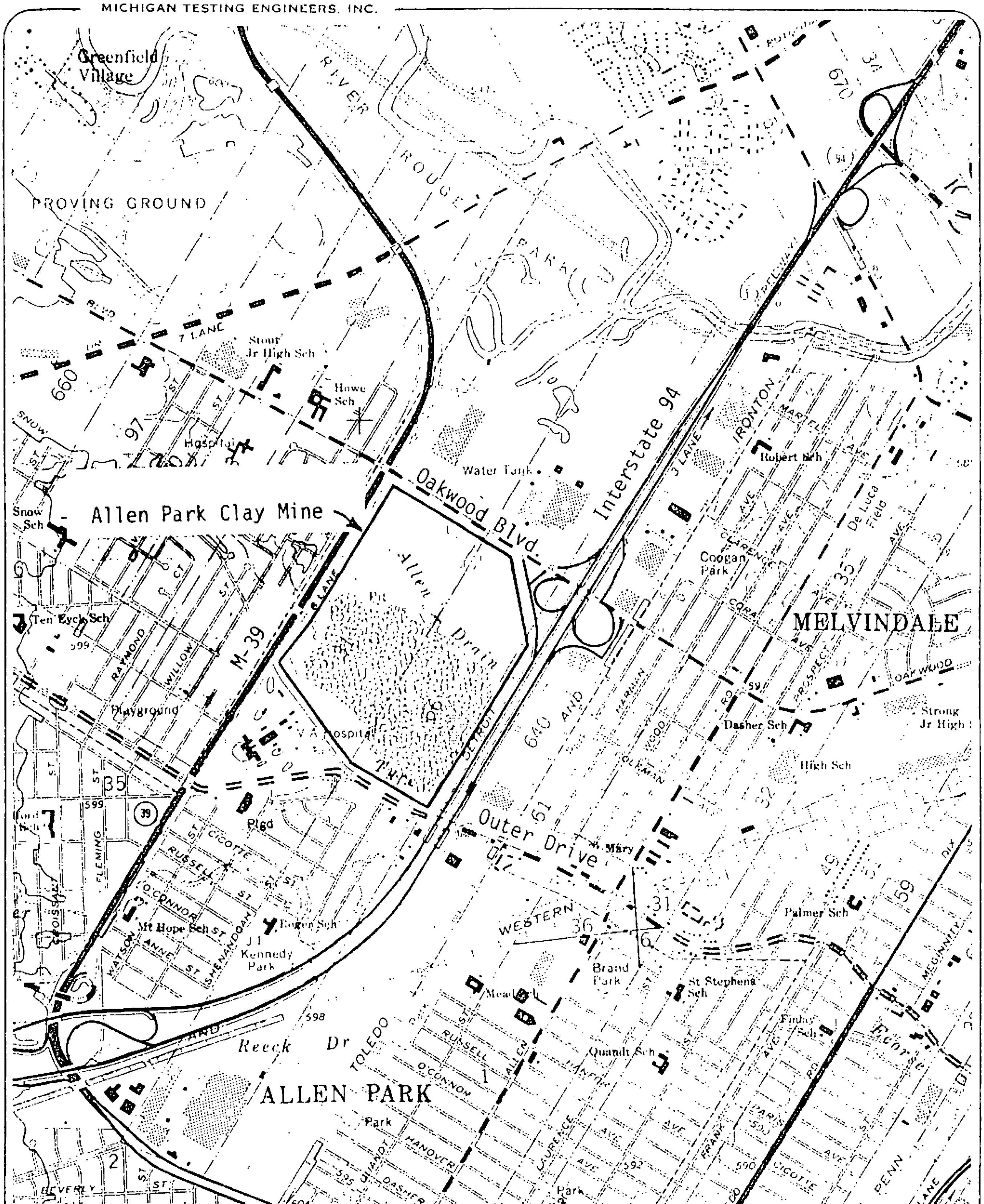
Existing Conditions

The Allen Park Clay Mine began operations in 1956. The 233 acre site is owned and operated by Ford Motor Company and presently is accepting only waste material from Ford Motor Company operations. A small portion of these wastes are classified as hazardous. It is planned to obtain an operating license for acceptance of hazardous wastes for a 16½ acre parcel within the site boundary. The limits of this area are shown on Figure 3. The types of classified hazardous waste to be disposed of include: Emission Control dust/sludge from the primary production of steel in electric furnaces (U.A. EPA Hazardous Waste No. K061) and Decanter tank tar sludge from coking operations (Hazardous Waste No. K087). Currently, only Cell No. 1 within the proposed licensing limits is accepting classified hazardous waste. The design elevation of the bottom of this cell is approximately +550 (USGS), or about 45 feet below grade.

Construction of a clay dike around the perimeter of the site is presently near completion.

Site Drainage

To facilitate removal of surface runoff at the site, a shallow ditch has been excavated partially around the outside of



0 1000 2000 3000 4000 5000

Scale - Feet
Contour Interval 5 Feet
Datum is Mean Sea Level

Allen Park Clay Mine
Disposal Landfill
Allen Park, Michigan
Wayne County

Figure 2

the perimter dike beginning along the Southfield Freeway (M-39) traveling northeast to Oakwood outside the clay dike, then southeast along Oakwood, around to I-94 where it empties into a temporary settling pond near Monitor Well W-103 before emptying into the Allen Drain, located approximately 250 feet southwest of Monitor Well W-103.

In addition, runoff from non-hazardous areas from within the facility are collected by ditches which empty into the perimeter ditch described above. A portion of the precipitation which collects in Cell No. 1 (where classified hazardous wastes are stored) will be used for dust control within this cell and any excess runoff will be hauled by tankers to the Ford Motor Company Rouge Plant. (Presently, Cell No. 2 contains no waste and runoff will be periodically pumped to the perimeter drainage ditch.)

The Tyre Drain collects runoff along Snow Road and Outer Drive as it travels to south to southeast direction towards I-94.

Both drains are enclosed as they travel southeast under I-94. The Tyre Drain empties into the Allen Drain which eventually empties into the Rouge River. A drainage map obtained from the office of the Wayne County Drain Commissioner is found on Figure 4.

From discussions with the Water Management Division of the Michigan Department of Natural Resources and others, it was learned that no portion of the site is contained within the limits of the 100 year flood plain of either the Rouge or Ecorse Rivers.

GEOLOGY

The present surface features of the area around southeastern Wayne County were formed during the Wisconsin stage of the Pleistocene glaciation. The Allen Park Clay Mine is situated within a glacial lake plain that was created when glacial meltwater became impounded between the moraines to the northwest and the receding Huron - Erie ice lobe to the southeast.

The surficial soils as shown on Figure 6 indicate deposits of either Lacustrine and Delta sand towards the northern half of the site and Lacustrine clay over the remainder. This, in general, was verified by the deposits of sand found at shallow depths at boring's W-101, W-102 and W-103 and the lack of a shallow sand deposit at W-104 and W-105.

The variation in composition and thickness of the glacial soils can be extreme for the glaciated area of southeast Michigan. However, the soils encourtered at the project site consists predominantly of silty clays with varying amounts of fine sand with occasional pebbles or fine gravel. The overburden material as shown on Figure 7 is generally anywhere from 80 to 100 feet thick as confirmed by soil borings and other available geological information.

The elevation of the bedrock surface within this region is likely to be irregular due to erosion both prior to the glacial epoch, and from later repeated glacial advances. Figure 8 reveals a difference in bedrock elevation of up to 25 feet across the Allen Park site. The type of bedrock immediately below the site consists of Middle Devonian Dundee Limestone approximately 75 to 100 feet in thickness underlain by 250 to 350 feet of Detroit River Dolomite of the same geologic period (See Figure 9). For additional detailed information refer to the deep well logs in Appendix H obtained from the Michigan Department of Natural Resources. (Please note that the deep well logs were used only as a guide since no known deep wells exist within approximately 1 or 2 miles of the site.)

SUBSURFACE CONDITIONS

General

The type of foundation materials encountered have been visually classified and are described in detail on the boring logs. The results of the field penetration tests, water level observations, laboratory water content, Atterberg limits and unit weight determinations are presented on the boring logs. Representative samples of the soils are now stored in the laboratory for further analysis if desired. Unless notified to the contrary, all samples will be disposed of after three months.

The stratification of the soils as described herein, and as shown on the boring logs represents the soil conditions in the actual boring locations; other variations may occur between the borings. Lines of demarcation represent the approximate boundary between the soil types, but the transition may be gradual.

It is to be noted that, while the test borings are drilled and sampled by experienced drillers, it is sometimes difficult to record changes in stratification within narrow limits especially at great depths. In the absence of foreign substances, it is also difficult to distinguish between discolored soils and clean soil fill.

Description of Foundation Materials

The following discussion is based upon subsurface information obtained from the soil boring data gathered from current and past geotechnical studies by Michigan Testing Engineers, Inc. at the Allen Park Clay Mine.

The soils encountered within the upper 10 to 15 feet at the boring (well) locations consist of either a fine to medium brown sand, a brown to gray silty clay or a mixture of these two soils types. The cohesionless soil types are generally loose to medium dense in consistency while the more cohesive soils are medium to stiff. Below these soils, a layer of gray silty clay was encountered and this stratum continues to a depth ranging from about 72 feet to 86 feet below the existing ground surface. This silty clay stratum contains, in general, 15 to 25 percent sand (4.75 mm - 0.074 mm) and usually not more than five percent fine gravel ($>$4.76 mm). The natural water content of this layer ranges from about 15 to 40 percent, with the average near 20 percent. Results of Atterberg limits determinations reveal liquid limits (LL) and plastic indices (PI) ranging from 17 to 52 percent and 7 to 29 percent, respectively. The majority of the samples, however, showed an average LL of about 28 and a PI of about 12. Classification of this material by the Unified Classification System indicates this soil to be predominantly a (CL) soil (Inorganic clay of low to medium plasticity). Within this strata, occasional zones of borderline (ML-CL) soils are present and one test confirmed a zone of (CH) soil. (A description of the Unified Classification System is found on Figure 10).

Eleven permeability tests were performed on selected shelby tube samples obtained from the silty clay stratum during the current field investigation. Results of these tests indicate the coefficient of permeability ranges from 1.8×10^{-8} cm/sec to 4.1×10^{-8} cm/sec. (Results of permeability tests from previous investigations are found in Appendices C, E and F.)

Below the silty clay, a layer of gray, saturated medium sand (SP) with a trace of fine gravel was encountered ranging from about one to six feet in thickness. This sand, in general, overlies an extremely dense layer of silty sand and clay (Hardpan). At boring (well) W-104 the sand layer, approximately 6 inches thick, is apparently sandwiched between two layers of the hardpan soils with the upper layer approximately 2½ feet thick. At W-101, the hardpan layer encountered was about one foot thick, underlain by a very stiff, very silty clay.

(Detailed soil boring logs are presented in Appendix A. A summary of laboratory test results was included previously on Table 2).

GROUND WATER

General

Except for a minor water table encountered within the shallow sand layer near the surface at W-102 and W-103, the only other ground water encountered during this investigation was within the sand and hardpan layers below the thick deposit of silty clay. The elevation at which this aquifer was encountered ranged from +505 (W-102) to +522 (W-105). This lower water bearing stratum is an artesian aquifer with static water levels reaching a height of up to 12 feet above the existing ground surface. From available literature, it is believed that this aquifer is recharged within the belt of moraines near west and northwest Wayne County. Figure 11 (taken from U.S.G.S. survey, circa: early 1900's) shows a contour map of artesian water in an area southeast of the Defiance Moraine. The artesian head is shown by lines of equal pressure. From this figure, the hydraulic gradient was calculated to be decreasing at a rate of approximately 3 to 4 feet per mile in an east-southeast direction. The static ground water elevations recorded at the monitor wells on November 4, 1981 are shown on the Ground Water Elevation Map in Figure 12. The recorded values show the general trend of groundwater eminating near Well No. 5 and flowing outward toward the other wells, and especially towards localized low areas near Well No. 7 and 2.

It is believed that the regional trend of ground water flow in this area is in the east-southeast direction, as shown on Figure 11, however, the water level readings shown on Figure 12 indicate ground water flow towards localized depressed areas near Well No's. 2 and 7. As more data becomes available, this condition can be verified.

It should be noted that the static water levels recorded at the site monitor wells are very similar to those shown on the artesian water contour map which may indicate a fairly consistent hydraulic condition exists within this aquifer. Also, permeability can vary within a confined aquifer due to local changes within lithology and therefore the piezometric surface may not be a smooth plane, but rather somewhat irregular.

Ground Water Quality

The latest chemical analyses of water samples obtained from the observation/monitoring wells at the Allen Park Clay Mine are shown on Table 3. Listed are all current wells, both within the deep and shallow aquifer, used to monitor both hazardous and non-hazardous landfilling operations. Listed on Table 3 (sheet 1 of 3) are the parameters for which the EPA has established interim drinking water standards. In general, the measured levels are at or below the established limits except for a few of the metals. At Well No. 2D (located within the deep aquifer), the measured level of cadmium was 0.24 mg/l; the EPA interim standard is 0.01 mg/l. It was suggested by Canton Analytical Laboratory (who performed the test) that the high cadmium level may be from the interior of the galvanized well standpipe. (It should be noted that cadmium levels at W-2 determined by the DNR during December, 1980 were below 0.020 mg/l.)

In addition, levels of lead at Well's W-2S, 5S and 10S ranged from 0.065 to 0.22 mg/l, which have exceeded the EPA interim standard of 0.05 mg/l.

Other parameters analyzed from monitor well samples are included on sheets 2 and 3 of Table 3. Currently, no established EPA standards are available for these parameters.

As additional ground water data becomes available, parameters which have exceeded recommended limits can be verified. (Refer to the ground water Monitoring Program section for the well sampling schedule and parameters to be analyzed).

Useability of Aquifers

Shallow Aquifer - The Michigan Department of Public Health does not permit drinking water wells to be located less than 25 feet below the ground surface. Since the upper, shallow aquifer was found to be generally less than 10 feet below grade, this aquifer is not a useable source of drinking water.

Deep Aquifer - The lower aquifer is located approximately 70 feet below the existing grade at the Allen Park site. Chemical analyses of ground water samples show this source to water to be highly mineralized. In addition, a few of the parameters for which the EPA has drinking water standards have been exceeded. Therefore, to use the lower aquifer as a source of drinking water would probably require treatment.

From discussions with the Wayne County Department of Environmental Health and the City of Allen Park Water Board, it was learned that no known water wells within Allen Park exist and that both residential and commercial water service are supplied by the city of Detroit.

SUMMARY CONCLUSIONS AND RECOMMENDATIONS

General

The results of this study indicate the geologic and ground water conditions at the Allen Park Clay Mine will permit the continued safe storage of the classified hazardous wastes. Soil borings made during the present and past studies reveal a thick, uniform silty clay layer (classified as predominantly a CL soil) which extends downward to an elevation ranging from +505 to +522 at the boring locations. Currently, the base elevation of Cell No. 1 is approximately +550. Therefore, the thickness of the clay layer below the cell is generally in excess of 25 feet. Laboratory permeability test results of undisturbed shelby tube samples of this silty clay layer from past and current studies at this site did not exceed 6.0×10^{-8} cm/sec.

In addition, no apparent continuous or extensive sand layers are present within this silty clay layer as confirmed during classification of secured soil samples.

Below the silty clay layer exists a lower, confined artesian aquifer with a static water level that, in general, rises to an elevation of +591 to +605 at the monitor wells. It is extremely unlikely that any leachate from the landfill will reach this aquifer, since there is a positive upward flow from the aquifer. The combination of the uniform, thick low permeable clays and the upward flow of ground water has created highly favorable conditions for containment of the hazardous wastes.

Ground Water Monitoring Program

Well No. 2 has been designated as the upgradient well and well number's W-102, W-103 and W-104 will be used as the downgradient wells for purposes of monitoring the ground water as required for the hazardous landfilling area. Additionally, it is recommended that Well No. 5 also be used as an upgradient well since the static water level at this location within the lower aquifer had the highest recorded elevation of the deep monitoring wells.

It is recommended that the proposed RCRA rules regarding groundwater monitoring for hazardous waste facilities published in the May 19, 1980 Federal Register (Parts 265.91 through 265.94, pp 33240-42) be used as guidelines for monitoring the groundwater at Well No's. W-2, W-5, W-102, W-103, and W-104 at the Allen Park Clay Mine. The parameters and sampling schedule as outlined in this document follows:

1) Parameters for which the EPA has drinking water standards:

Arsenic	Endrin
Barium	Lindane
Cadmium	Methoxychlor
Chromium	Toxaphene
Floride	2, 4-D
Lead	2, 4, 5-TP Silvex
Mercury	Radium
Nitrate as N	Gross Alpha
Selenium	Gross Beta
Silver	Coliform Bacteria

Concentrations of the above parameters should be tested on a quarterly basis for the first year.

II) Water Quality Parameters:

Chloride	Phenols
Iron	Sodium
Manganese	Sulfate

III) Contamination Indicators: (At least four replicate measurements must be obtained for each sample).

pH	Total Organic Carbon
Specific Conductance	Total Organic Halogen

After the first year, ground water quality parameters (Part II) must be analyzed at least annually and the Contamination Indicators (Part III must be analyzed at least semi-annually.

Ground water elevations should be determined at each monitoring well when sampling for chemical analysis. (Depending upon the climatic conditions and seasonal fluctuations within the aquifer, one or more of the monitor wells may be flowing. Therefore, to obtain a true ground water level, the flowing well must be extended with a coupled section of PVC pipe to allow the water level to stabilize. The well should be allowed to stabilize for at least one week to account for hydraulic lag prior to monitoring.)

The remainder of the monitoring wells should be sampled and analyzed for the standard parameters as required by the Michigan Department of Natural Resources for Type II Landfills.

Additionally, it is recommended that samples of the hazardous waste leachate be analyzed for the same parameters as outlined above for ground water samples for purposes of comparison.